

Journal of Biomedical Optics

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Abstract. Scabies is an intensely pruritic disorder induced by a delayed type hypersensitivity reaction to infestation of the skin by the mite *Sarcoptes scabiei*. The diagnosis of scabies is established clinically and confirmed by identifying mites or eggs by microscopic examination of scrapings from the skin or by surface microscopy using a dermatoscope. Reflectance-mode confocal microscopy is a novel technique used for noninvasive imaging of skin structures and lesions at a resolution compatible to that of conventional histology. Recently, the technique was employed for the confirmation of the clinical diagnosis of scabies. We demonstrate the first ever documentation of a larva moving freely inside the skin of a patient infected with scabies. © 2012 Society of Photo-Optical Instrumentation Engineers (SPIE). [DOI: [10.1117/1.JBO.17.6.060503](https://doi.org/10.1117/1.JBO.17.6.060503)]

Keywords: scabies; confocal microscopy.

Paper 11692L received Dec. 4, 2011; revised manuscript received Apr. 25, 2012; accepted for publication Apr. 26, 2012; published online May 25, 2012.

Scabies is an intensely pruritic disorder induced by a delayed hypersensitivity response to infestation of the skin by the mite *Sarcoptes scabiei*. The female mite penetrates the skin and excavates a burrow in the stratum corneum. During the next 2 to 3 weeks it lays 3 to 4 eggs daily, which hatch after 3 to 4 days. Newly hatched larvae exit the burrows and appear on the surface of the skin where they continue their development until they reach the adult stage. Infestation may occur by sharing clothing, towels, and bedding and is easily spread among sexual partners and household members.

Dermatoses related to a delayed type hypersensitivity response usually start 3 to 4 weeks after initial infestation with mites and are accompanied by intense pruritus. The itching

may affect all parts of the body and is particularly intense at night.

Crusted (“Norwegian”) scabies is characterized by the involvement of all parts of the body including head and neck. Crusted scabies may begin as ordinary scabies with burrows, papules, and vesicles but eventually develop into a keratotic reaction. The condition usually affects elderly patients or those who suffer from mental deficiency, neurological disorders, or immunosuppression. The burden of mites can reach several thousands in immuno-compromised patients.^{1,2}

The clinical diagnosis of scabies is established by detection of burrows in connection with a papular or crusted rash. The diagnosis is confirmed by identifying mites or eggs by microscopic examination of scrapings from a burrow or by surface microscopy using epiluminescence microscopy (ELM) or a dermatoscope.^{3,4} Reflectance-mode confocal microscopy (RCM) is a novel technique used for noninvasive imaging of skin structures and lesions at a resolution compatible to that of conventional histology. Recently, RCM was used for *in vivo* demonstration of scabies mites.⁵

Treatment is aimed at terminating the mite, and it includes several topical scabicides or systemic ivermectine. Both modes of treatment are not short of side effects, yet retreatment is often prescribed arbitrarily due to lack of sufficient clinical markers for treatment’s effectiveness. *In vitro*, parasite death is defined as cessation of peristalsis of the gut and absence of movements of the mite over 24 h.⁶ *In vivo*, RCM seems to be the only technique enabling determination of mite viability.⁷

RCM provides a virtual 3-D image of the tissue by serial sections at various depths.⁸ The system uses an 830 nm wavelength diode laser and provides high optical resolution (horizontal axis 2.0 μm ; vertical axis 5.0 μm) to a penetration depth of 200 to 300 μm depending on anatomical site and skin thickness. Whereas only adult mites were described in the above-mentioned publications, we herein present the first *in vivo* documentation of a freely moving larva surrounded by abundant eggs.

We report a case of a 67-year old immunosuppressed female, diagnosed with crusted scabies. Most of her skin was covered with papules and crusted plaques (see Fig. 1). Skin examination using *in vivo* RCM revealed the presence of numerous eggs occupied by mite embryos, fecal material, as well as mite burrows (see Fig. 2). All of these were observed at the level of the stratum granulosum–spinosum, judged by the characteristic honeycomb pattern of the surrounding epidermis. It was also possible to observe a living larva moving freely within the burrow (see Video 1). The larva appears to try to escape the external pressure induced by the microscope probe. The larva differs from the adult mite by its size and its ability to move faster within a burrow in the skin.

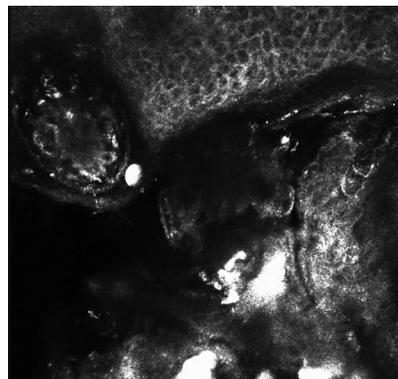
Microscopic evaluation from skin scrapings is done *in vitro*, and ELM or dermoscopy allow only gross, un-detailed, *in vivo* visualization of the adult mite. RCM’s main limitation is its initial high cost. Despite that, only RCM allows a detailed *in vivo* inspection of both adult mites and larvae, enabling a glimpse into the actual manner the mites conduct themselves inside the human skin. Furthermore, RCM permits *in vivo* establishment of mite viability consequently eliminating unnecessarily repeated treatments.

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Fig. 1 Scaled crusted plaques on the patient's left shoulder.



Video 1 At the bottom right corner, a rapidly moving object is observed. Focusing on this object reveals a freely moving larva advancing within an existing burrow. (QuickTime, 12.0 MB) [URL: <http://dx.doi.org/10.1117/1.JBO.17.6.060503.1>].

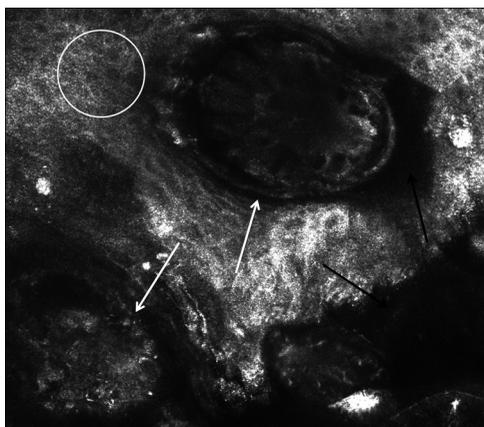


Fig. 2 *In vivo* reflectance confocal microscopy image of burrows and mite's eggs: Scabies eggs (white arrows), with embryos in them, are seen within burrows (black arrows), at the level of the stratum granulosum-spinosum (white circle marks the characteristic honeycomb pattern).

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